



*Hands-on railroad experience,
world class consultancy skills*

North America

An aerial photograph of London, England, showing the city skyline. The Shard skyscraper is prominent on the left. In the foreground, the roof of London Bridge Station is visible, with its distinctive curved structure. The River Thames flows through the city, and various other buildings and infrastructure are scattered throughout the scene.

We know how to run a railroad because we do it every day

Network Rail

Network Rail owns, operates and develops Britain's mainline rail infrastructure; that's 20,000 miles of track, 30,000 bridges, tunnels and viaducts and thousands of signals, grade crossings and stations. It manages 20 of the UK's largest stations while all the others, over 2,500, which are owned by Network Rail, are managed by the country's train operating companies.

Every day, Network Rail dispatches and manages the operation of over 20,000 trains carrying more than 48 million journeys. People depend on Britain's railway for their daily commute, to visit friends and loved ones and to get them home safe every day.

As part of Network Rail's multi-billion dollar Railway Upgrade Plan key projects such as Birmingham New Street Station, Great North Rail Project, Great Western Mainline and the Thameslink Program are transforming Britain's network to meet the tremendous growth the railway has experienced in the past 20 years.

Network Rail Consulting

Network Rail shares its expertise with the world's rail operators through Network Rail Consulting. We understand the institutional, regulatory, technical, policy and strategic issues of running a 19th century railway in the 21st century. We know how to operate a network, manage its assets and deliver enhancement programs.

We have unrivalled expertise in getting more out of legacy infrastructure, operating in a closely regulated market and continuously upgrading an active, heavily used rail system.

What makes us different from other consultants is that our people have genuine hands-on experience in solving the challenges you face in the day-to-day delivery of rail services. We are men and women operating and maintaining one of the world's leading railway systems who want to share their expertise, experience and passion for the job.

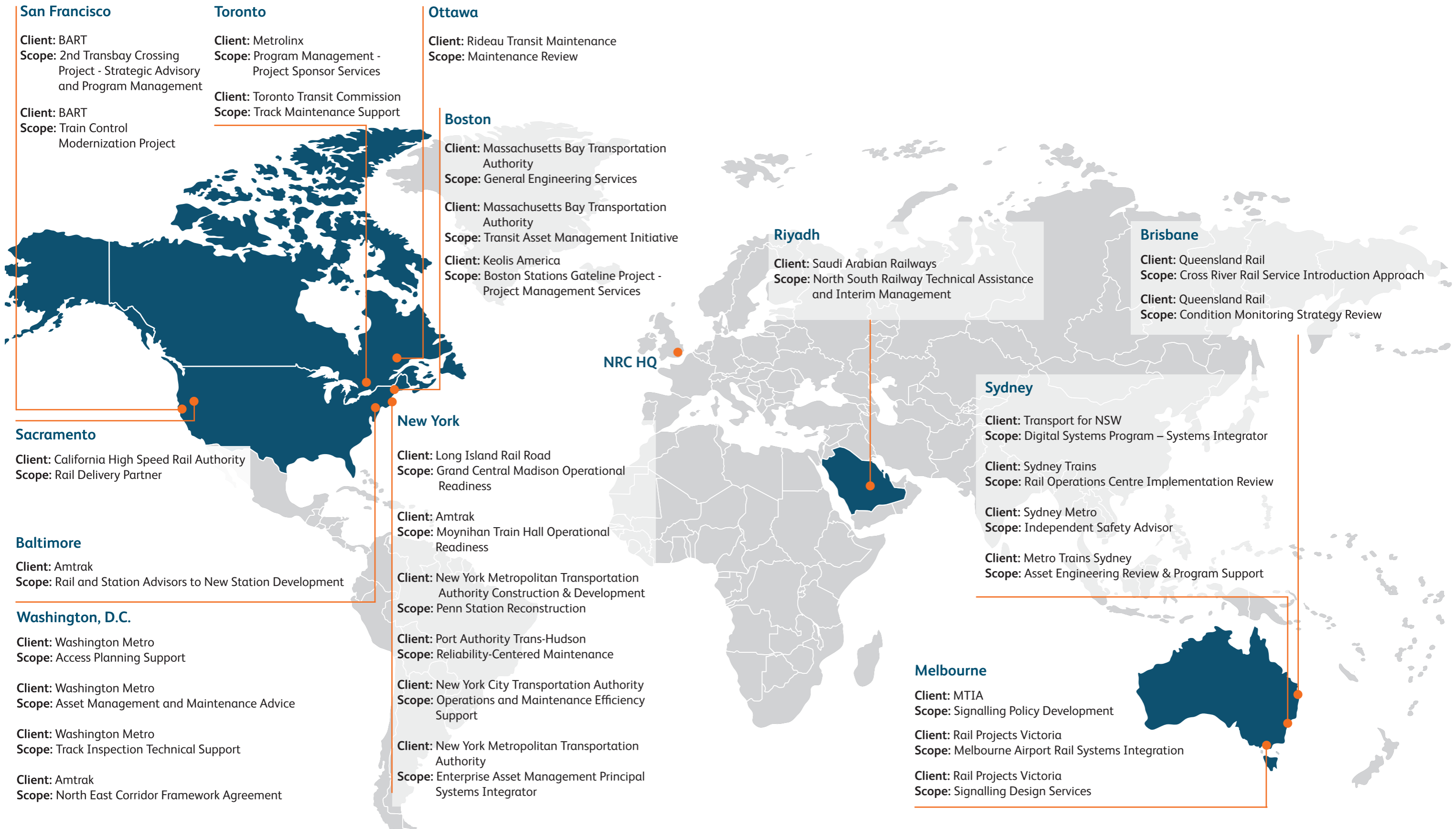
Network Rail Consulting in North America

We have been active in the North American market since 2015 and have successfully delivered more than 70 consultancy contracts across Canada and the USA.

Our advice has covered the full range of the project life cycle, from concept and project delivery through to operations and maintenance.

While our unique selling point is our access to Network Rail's expertise in the UK, we are committed to developing our local workforce through a structured training and development program using Network Rail's award winning training capability. This will ensure that we continue to provide our clients with leading edge technical and management advice delivered by a blend of North American and British railroad professionals.

Network Rail Consulting Around the World



Advisory and Strategic Planning

We can advise national and regional governments, rail infrastructure owners and operators on optimized approaches to structure, set up and run rail services. Unlike many traditional consultants, our people have hands-on railroad experience. We don't base our analysis and recommendations on how railroads behave purely in theory. Instead, we use our understanding of the theory combined with our knowledge of what actually happens in practice in a regulated railroad environment (safety and economic regulation). Our expertise extends across the strategic spectrum, to cover aspects such as industry restructuring, change management, business planning and strategy development building on our experience of transforming Britain's rail system to become a world leader in safety, performance and efficiency over the past 17 years.

We can also help with rail service contracting (including bidding, specification and evaluation), station planning, demand and revenue forecasting, creation

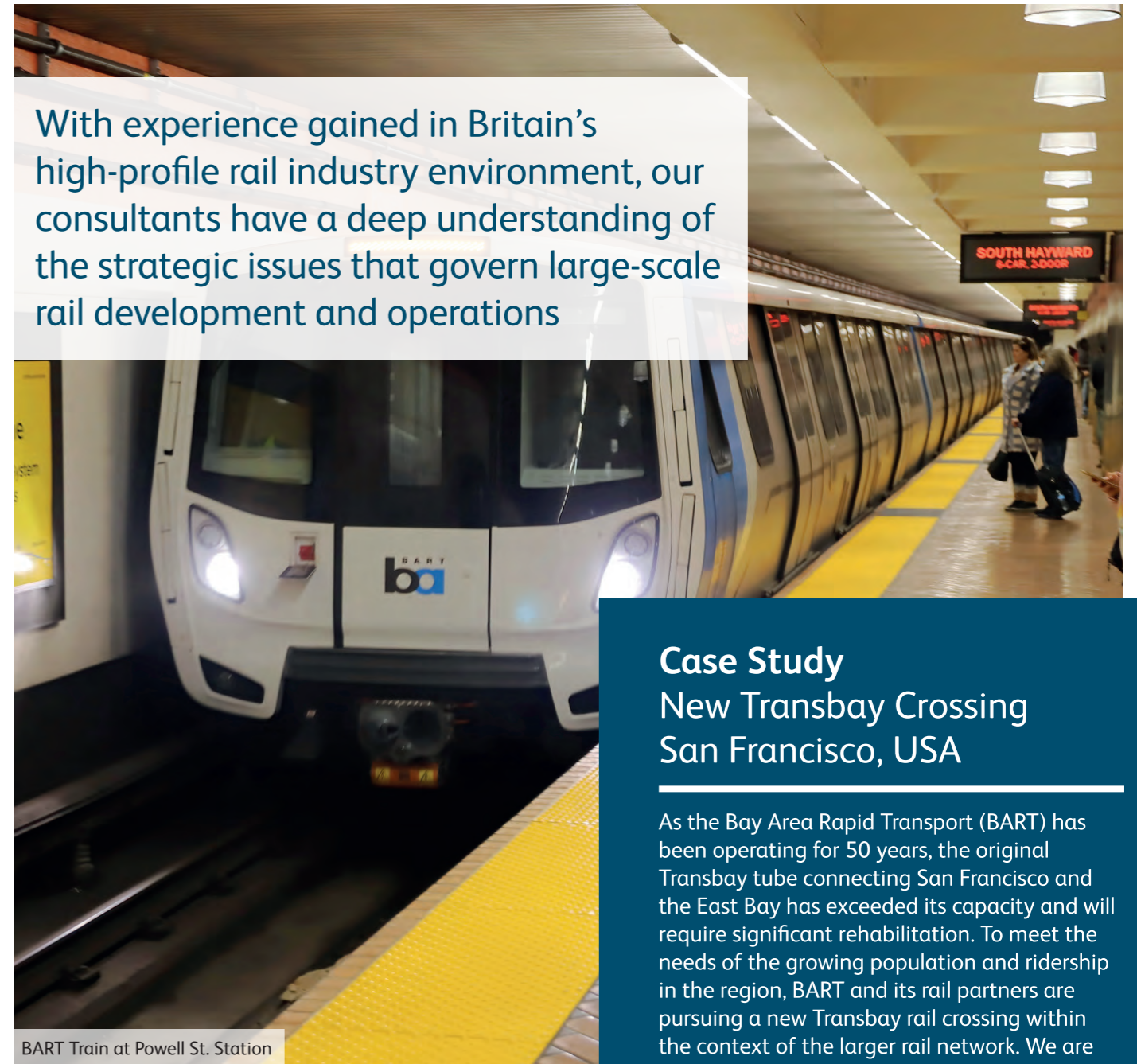
and negotiation of access agreements, customer satisfaction monitoring and train performance improvement plans.

By auditing your procurement processes we can identify potential savings and work with you to implement a transparent, non-discriminatory sourcing system which complies with international best practice. We can help you set up partnering alliances with major suppliers and sustain best practice.

Benchmarking against comparable rail organizations in other countries is one of the best ways to assess the management and operations of railroad systems. Our consultants are experienced in organizational change and transformation management in the rail industry. This experience can provide agencies with high value propositions against an increasing need to enhance financial performance.



Grand Central Terminal, New York



BART Train at Powell St. Station

With experience gained in Britain's high-profile rail industry environment, our consultants have a deep understanding of the strategic issues that govern large-scale rail development and operations

Case Study New Transbay Crossing San Francisco, USA

As the Bay Area Rapid Transport (BART) has been operating for 50 years, the original Transbay tube connecting San Francisco and the East Bay has exceeded its capacity and will require significant rehabilitation. To meet the needs of the growing population and ridership in the region, BART and its rail partners are pursuing a new Transbay rail crossing within the context of the larger rail network. We are part of an international team of consultants providing strategic advice to BART on the new Bay crossing.

Our role is to lead on defining the business case, the business plan, alternative funding options, the approach to project and program management; and to advise and coordinate stakeholder engagement, project phasing, project delivery and procurement.

Project and Program Management

Legacy rail networks designed for a different era present their owners and operators with major constraints to modernization, as we know only too well. Sometimes it's possible to make marginal system improvements, but eventually the time comes to make the big decisions.

We have successfully delivered a number of large-scale projects such as London Bridge station and creating new infrastructure that links seamlessly into the existing network such as London's Crossrail Project. Every year, our team carries out thousands of enhancements to our track, bridges, tunnels, buildings & civils, signaling, power & electrification and telecommunications network.

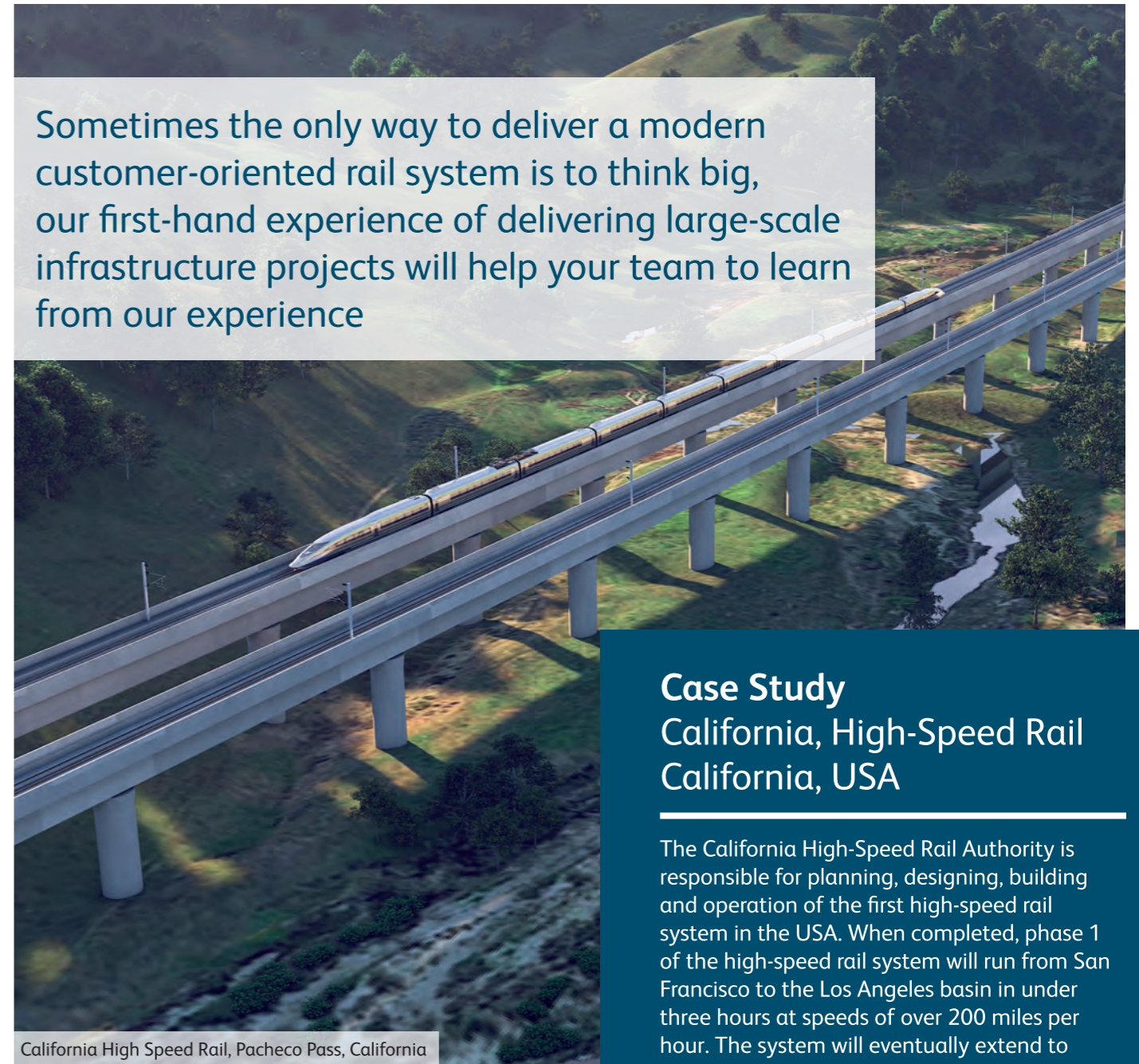
Our network is heavily used, so it's essential to limit the impact to train services so that customer disruption is kept to an absolute minimum. Works are largely undertaken during night and weekend track outages, and during holiday periods, leaving weekdays largely

unaffected. The planning for these outages (track time) periods is highly complex, requiring close project management. We have been very successful at maintaining services through optimizing train paths while keeping our customers informed about disruptions.

We can provide you with an integrated team who will help you manage the planning, design, procurement, construction, operations and maintenance of your projects. Our focus is always on safely completing projects on time and within budget to deliver an enhanced service to customers.



Trains Approaching Union Station, Toronto, Ontario



California High Speed Rail, Pacheco Pass, California

Sometimes the only way to deliver a modern customer-oriented rail system is to think big, our first-hand experience of delivering large-scale infrastructure projects will help your team to learn from our experience

Case Study California, High-Speed Rail California, USA

The California High-Speed Rail Authority is responsible for planning, designing, building and operation of the first high-speed rail system in the USA. When completed, phase 1 of the high-speed rail system will run from San Francisco to the Los Angeles basin in under three hours at speeds of over 200 miles per hour. The system will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations.

As part of the Rail Delivery Partner consultancy team, our Sacramento office is proposing standards for operation and maintenance, proof of concept operations, assisting the client in selecting a preferred bidder for different stages of the project and providing systems integration for the holistic engineering elements of the project.

Systems Integration

Technology is enabling huge improvements in the efficiency and capacity of railroad networks, but it brings with it significant challenges in specification, design, implementation and delivery of the benefits for which it was purchased.

Railroad technology projects frequently involve multiple suppliers and interact with multiple parts of the railroad system and the railroad company's organization across complex interfaces. Realizing the benefits of new technology often involves wholesale changes to the operation of the railroad, affecting everything from long-term service planning to delivery of operations on the day. The roles and responsibilities of individuals are affected, with some tasks no longer required and the need for new roles to be specified.

Making the different elements of the technology work together and, more importantly, to work with your railroad organization to deliver the service you want, requires a combination of expertise, experience

and formal techniques. Whether it is operational performance modeling to disaggregate the reliability requirements of the engineering components of a new system, or an assessment of the degraded mode operating scenarios and how the technology and the people will operate under them, we have both the tools and the experience to help you set and manage your requirements.

As well as practitioners of systems engineering, we can add subject matter experts in areas such as operating rules, signaling principles and reliability engineering, who will work together so that your project will provide the benefits you set out to achieve.



Washington Metro, Washington, D.C.



Rail technology projects are more complex than ever before and therefore delivering successful technology projects requires a combination of know-how, experience and formal methods

Digital Railway System

Case Study Supporting Digital Railway, Sydney, Australia

The Digital System project in Sydney is part of the More Trains, More Services program to dramatically increase the capacity of the Sydney Trains network to accommodate anticipated passenger growth by 2030. The Digital Systems program is focused on investigating circa A\$800m (US\$560m) in the implementation of ETCS level 2 digital signaling and Traffic Management, together with associated upgrades to the train Onboard units, Digital Train Radio System (DTRS) and fixed Telecoms Network (FTN). The program is being delivered by Transport for New South Wales on behalf of Sydney Trains, who will be the end user and operator.

Network Rail Consulting was appointed as Digital Systems Integrator in 2018 and is responsible for the system specification, system integration, system assurance, system integration testing and technical oversight of the program.

Rail Operations

We run one of the busiest, oldest and fastest-growing rail systems in the world. And, despite the pressures of managing a bustling system in a turbulent real-world operating environment, we've succeeded in increasing capacity, enhancing safety and providing a better service for customers and staff alike.

Experience of the latest systems and operational practices gives us a unique perspective on how a modern railroad can function. Our consultants can work with your people or as external advisors to review the current status of your operations and develop strategies for optimizing services.

We are currently creating a new control system for the British network, based on 12 new control centers. This will replace legacy signaling systems, some of which date back to the pre-war era.

The experience we have gained during major upgrades means that we can help you to plan, develop and safely integrate new signaling centers into your network.

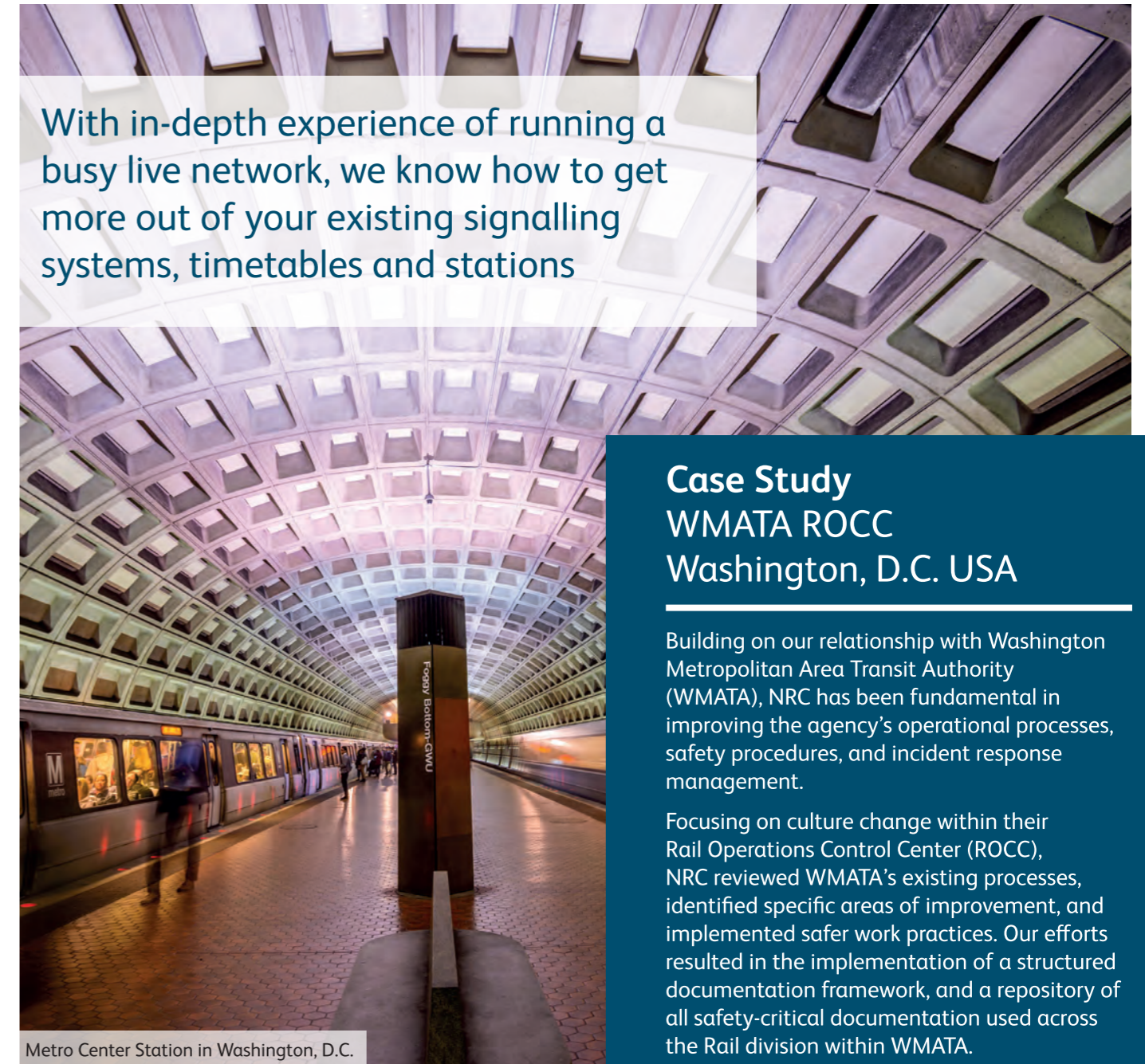
We have developed a suite of modeling services that will enable you to analyze timetable efficiency and predict the impact of service disruptions. They enable us to advise you on optimized ways to accommodate train services without sacrificing the performance of the network. These tools are in daily use as we work with Britain's train-operating companies to review their proposed service patterns.

By applying modern operating techniques, we have been able to run more trains on a smaller network, reduce operating costs, increase passenger numbers, reduce track closure times, extend component/system life and achieve better integration of technology, without compromising on safety.

Our railroad professionals have been at the forefront of this work, and we can help you unlock more efficient operating practices, using modern technology and processes to drive performance improvements and cost savings.



Network Rail Control Room



Metro Center Station in Washington, D.C.

With in-depth experience of running a busy live network, we know how to get more out of your existing signalling systems, timetables and stations

Case Study WMATA ROCC Washington, D.C. USA

Building on our relationship with Washington Metropolitan Area Transit Authority (WMATA), NRC has been fundamental in improving the agency's operational processes, safety procedures, and incident response management.

Focusing on culture change within their Rail Operations Control Center (ROCC), NRC reviewed WMATA's existing processes, identified specific areas of improvement, and implemented safer work practices. Our efforts resulted in the implementation of a structured documentation framework, and a repository of all safety-critical documentation used across the Rail division within WMATA.

Further to this success, we are subsequently providing subject matter expertise for WMATA's broader Incident Management Framework contract, improving how the authority responds to and manages incidents. Incorporating industry best practices, lessons learned, and aligning with FEMA's National Incident Management System, WMATA will lead the way in Incident Response in one of the United States' busiest transit systems.

Maintenance

Whether you are looking to reduce maintenance costs, are constrained by limited rail corridor access or you want to get better reliability without spending more, we have the tools, techniques and experience to help advance your maintenance regime design.

Reliability Centered Maintenance can help you optimize your maintenance, spending more time on tasks that drive reliability and less time doing tasks that add little value. With Risk Based Maintenance, you can evolve to build your maintenance plan to concentrate effort on those assets that have the biggest impact on your operation.

Technologies such as Automated Inspection and Remote Condition Monitoring can help you identify defects before they impact train services, allowing you time to plan an effective repair, saving you downtime and reducing your unplanned corridor access, meaning your staff can undertake the work more safely.

Network Rail has two decades of history not just in the technical aspects of maintenance, but also in implementing changes in a unionized work environment. Our Plain Line Pattern Recognition Technology regularly inspects 4800 miles of track, removing the need for staff to walk the line. Our Remote Condition Technology monitors over 40,000 assets from switches and track circuits to power supplies and rail temperatures and has resulted in fewer train delays. Network Rail Consulting has undertaken projects worldwide sharing our experience and helping railroads like yours to deliver more effective and efficient maintenance.



Rail Track Maintenance Worker

Preventative measures save time and money; with intelligent use of integrated monitoring and measurement technology you can cut maintenance costs, increase safety margins and improve service availability



MBTA Subway Lines, Train Crossing Longfellow Bridge, Boston

Case Study Transforming Maintenance, Boston, United States

Our Boston office has been working with the Massachusetts Bay Transportation Authority (MBTA) since 2016 to help bring the system to a "state of good repair", leveraging our experience from the UK.

We have worked with MBTA to put in place a series of initiatives to improve asset management and maintenance across a number of departments. For example, an improved track inspection program incorporating competency assessments, new guidelines, dashboards, training videos and a mentoring program has resulted in a 77% reduction in track-caused speed restrictions over a three-year period. By working side-by-side with track supervisors to improve track maintenance management and assurance of track repair work, we have also helped MBTA reduce the number of critical track defects, improve asset condition towards a state of good repair and reduce the risk of derailments.

Asset Management

Establishing effective asset management is the first step to achieving and maintaining a state of good repair. Our experience in renewing an entire national network has shown that a carefully planned and managed approach pays big dividends in reduced costs, improved service and increased passenger numbers.

This systematic approach has made us a world leader in developing and applying integrated tools and techniques to monitor and manage rail assets. The route from asset management theory to practice is a long one and it encompasses every part of the organization from IT and HR to finance and operations as well as the traditional engineering disciplines. We have been independently assessed as one of the most mature asset management organizations in the rail sector and in the top quartile across all the asset-based utility sectors. We can help optimize this path, helping apply the best practices we have developed as a rail

system owner and operator while supporting early identification of challenges and hurdles.

We have made marked improvements in our own asset management through an integrated program of enabling mechanisms. These include improvements to asset data specifications and capture, decision support tools, investment in people and competencies, integrated processes, asset policies, strategic asset management planning, reliability modeling and whole life cost tools which evaluate the trade-off between cost, performance and risk.

We can help you understand your own asset management maturity, using internationally recognized assessment models. From there we can help you develop a roadmap to deliver the benefits that good asset management brings. Most importantly, we can bring you practical, implementable solutions based on our extensive experience.



Two Subway Trains, Queens, New York



Railroad Track Switch Detail

Rigorous asset management techniques can reduce whole-life-costs, minimize asset failure and improve overall service delivery

Case Study Principal Systems Integrator New York, USA

Our New York office, working as part of an integrated team led by DXC, were responsible for the development of the asset information strategy and management framework for the New York MTA and its associated agencies building on the successful implementation of a similar system in Network Rail. The framework, guidance and standards produced align with ISO 8000, ISO 55000 and PAS 1192 to support MTA's goal to achieve ISO 55000 certification and BIM Level 2 as an organization.

Our team played a key role in the change management workstream, producing a benefits realization strategy and framework to define, capture and track the ongoing financial efficiencies resulting from deployment of EAM tools and technology. We have also supported the 'piloting' of these systems to ensure end-users requirements are met and helped the development and roll-out of training modules.

Local presence - international expertise

Our approach is to provide the right blend of international best practice coupled with railroad professionals who are familiar with the North American operating, regulatory and political context, so that we provide advice that is appropriate for local circumstances. We draw our core expertise from Network Rail, the owner and operator of Britain's rail infrastructure. Together with locally based teams in North America, a key part of our offer is our ability to reach back to our colleagues in the UK to access the latest advice, world class expertise, and provide additional technical resources during periods of peak workload demands.

Our North American team is able to provide railroad owners, operators, State and Federal agencies, a wide range of advice covering:

Advisory and Strategic Planning

- ▶ Benchmarking, Auditing and Due Diligence
- ▶ Appraisal, Cost Benefit Analysis and Forecasting
- ▶ Institutional Advice
- ▶ Organizational Change and Transformation Management
- ▶ Performance Regime Design and Management
- ▶ Rail Franchising – Bidding, Specification and Evaluation
- ▶ Policy Development

Stations and Commercial Development

- ▶ Station Design Principals
- ▶ Station Scoping and Requirements Setting
- ▶ Operations and Maintenance and Asset Management Plans
- ▶ Retail and Space Optimization
- ▶ Customer Information Development

Maintenance

- ▶ Access Optimization
- ▶ Design and Implementation of Training
- ▶ Design, Modification and Implementation of Maintenance Management Systems
- ▶ Design of Outsourced Operations and Maintenance (O&M) Contracts
- ▶ Planning Maintenance Facilities
- ▶ Systems Automation

Major Projects

- ▶ Access Planning
- ▶ Client Side Delivery Partner
- ▶ Construction Management & Operations Planning
- ▶ Development and Roll Out of New Digital Train Control Systems
- ▶ Project and Program Management
- ▶ Reporting & Documentation
- ▶ Risk Management
- ▶ Scheduling
- ▶ Stakeholder Management
- ▶ Systems Integration
- ▶ Value Engineering

Rail Operations

- ▶ Operational Infrastructure Planning and Optimization
- ▶ Operations Control and Management Systems
- ▶ Performance Analysis and Modelling
- ▶ Shadow Operator Services
- ▶ Simulation Modelling and Timetabling

Asset Management

- ▶ Asset Degradation Modelling
- ▶ Conceptual Design of Asset Management Plans
- ▶ Data Capture
- ▶ Enterprise Asset Management Systems
- ▶ Remote Condition Monitoring
- ▶ Risk Based Maintenance
- ▶ Route Asset Management Plans
- ▶ Whole Life Evaluation



International Presence

- ▶ *Boston*
- ▶ *Melbourne*
- ▶ *Sacramento*
- ▶ *Toronto*
- ▶ *Brisbane*
- ▶ *New York*
- ▶ *San Francisco*
- ▶ *Washington, D.C.*
- ▶ *London*
- ▶ *Riyadh*
- ▶ *Sydney*

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